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ABSTRACT

The purpose of this program has been to develop a competency-based curriculum that will form in prospective elementary teachers the methodology of science teaching reflected in the newer generations of elementary science curricula. The program involves around the basic premise that the student should concentrate not so much on content as on processes and methods of discovery and investigation. It consists of a series of modules, the majority of which involve "hands-on science" and dealing with the real world, whether in the laboratory or out-of-doors. In evaluating the program, a variety of qualities is measured in order to ascertain whether or not the goal is being reached. The two basic qualities are changes in attitude and development of process skills. Significant progress in both these areas is evident. (PB)

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53

Distinguished Achievement Award Entry

Submitted to

American Association of Colleges for Teacher Education

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Title of Program: A Humanistic, Competency-Based Curriculum for Preservice Elementary Teachers

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Summary of the Program

The College of St. Teresa is nearing the completion of a four year developmental program resulting in the finalization of a science curriculum for prospective elementary school teachers. The purpose of the program has been to develop a competency-based curriculum that will form in prospective elementary teachers the methodology of science teaching reflected in the newer generations of elementary science curricula. Further, the science faculty hopes to lead the students to experience the liberalizing effect of science understood as a distinct mode of knowledge. It is proposed that our preservice teachers, after completing this program, will be capable of implementing an inquiry, activity-oriented, humanistic instructional program for children. The science program, consisting of Unified Science I, II, III, is team taught by four faculty members and has a credit value of 12 semester hours. Unified Science III includes Curriculum and Methods in Elementary Science. The science curriculum which is being developed, implemented, and revised during a four year grant period (NSF #GY 9290*, June 1971 - August 1975) will be available to interested colleges and universities.

* Undergraduate Preservice Teacher Education Program (UPSTEP) sponsored by the National Science Foundation, Washington, D.C.

Development, Description, and Objectives of Program

In 1969-1970, the science faculty members from the College of Saint Teresa became interested in improving the quality of the then existing science program for elementary education majors (formerly the science program for these majors consisted of a one-semester credit course in science methods, a six-semester credit course in biological science, and a six-semester credit course in physical science). Some faculty members involved in the planning of the proposed program made a concerted effort to keep abreast of the latest developments in elementary science teacher education. They studied a variety of the nine Elementary Teacher Training Models (USOE) and participated in the Chicago Regional AAAS Conference (November, 1969) which revolved around the preliminary AAAS Standards and Guidelines for Preservice Science Education of Elementary Teachers. Ideas for the initial proposed program also came out of meetings and a variety of publications of the AACTE. From these and other sources the planners agreed on several basic premises that would guide them in setting their goals for the proposed program. These basic premises are listed below.

1. A preservice teacher of elementary science should have a wealth of experience in process skills and methods of investigation before she can become proficient at teaching these skills to children.

   The argument of "process versus content" has been with the UPSTEP staff since the initial stages of development of the curriculum. We have consistently favored the argument that there is a need to stress process more than content. The staff was (and still is) convinced that prospective elementary teachers in their science experience need not be taught all the content they might possibly use in their teaching nor need they be subjected to all the content thought to be absolutely essential in "traditional" science courses. A student who plans to be a teacher of science in the elementary classroom needs to be experienced, however, in the various processes used in science teaching and in science investigation.

   Too often the college science requirements demanded of a preservice elementary teacher consist of traditional lecture-style science courses and the addition of a science methods course. The planners felt that the elementary education majors should experience the total science program in much the same manner that they, the students, would eventually teach science to children. Thus, the total science package should unify the methods of investigation with the methods of teaching science to children.

2. The preservice teacher who is given the opportunity to experience the joy of discovery will be more apt to involve children in similar experiences.

3. Creating and sustaining curiosity about nature's workings can come about more easily if the college student has some freedom in selecting the science content she wishes to investigate. Therefore, the thread of consistency in such a proposed program whould be found in the manner whereby an investigation is carried out and not so much in the science content to be learned.

These basic premises led to the following objectives for the UPSTEP program at the College of Saint Teresa.

(1) To introduce the student to an inquiry approach in the study of science as a "hands-on" activity and as a self-paced, performance-based activity.

(2) To allow the student satisfaction in the discovery of science knowledge and to make her aware that discovery is within her capability.

(3) To help the student realize that science is a distinct mode of knowledge and a real part of her general education.

(4) To introduce the student to the various disciplines within the scientific realm--biology, physics, chemistry, astronomy, geology, space and environmental science--especially as these disciplines appear in ESS, SCIS, and SAPA.

(5) To help the student grow in the scientific processes as delineated by SAPA.

(6) To help the student see that science is part of the everyday world.

(7) To make the student aware that the inquiry approach to the learning and teaching of science is applicable to other areas of knowledge.

(8) To give the student an opportunity to study, discuss, and evaluate the philosophies of several recent curriculum projects, e.g., SAPA, ESS, and SCIS.

(9) To give the student an opportunity to study science and experience the inquiry approach by using modules based directly on these curriculum projects (SAPA, ESS, and SCIS).

(10) To give the student experience in the development and implementation of a module in science.

(11) To give the student actual experience in the teaching of science to children by an inquiry approach as a prelude to her student teaching.

With the above objectives in mind, the faculty involved in the program developed a series of Modules (MODS) which would serve as a basis for student involvement and study. The following table will show the Unified Science sequence.

Unified Science Sequence

	Fall	Winter	Spring
Sophomore Year		Unified Science I Attitude pretest administered. Process pretest administered. Pool of 51 Science MODS offered - 13 required and 11-21 elected.	Unified Science II 50 MODS offered - 13 required, 12-22 elected. Several field trip options. Heavy in environmental/ outdoor educ. options.
Junior Year	Unified Science III 36 MODS offered - 16 required, including teaching children. Less electives offered. Field trip options. Seminars on el. ed. science programs offered. First posttest of attitudes. Posttest of process skills.	Student teaching can be taken in this or any one of the following terms. Science faculty member observes science teaching. Second posttest of attitudes after completion of student teaching.	Student teaching etc.

At the beginning of each course, students receive packets of 40-50 learning modules (MODS), 13-16 of which are required and 4-22 of which can be selected from the remaining electives. In Unified Science III, the number of MODs required is reduced due to the inclusion of more time-consuming MODS, e.g., teaching of children. A listing of the MODS offered for Unified Science I is attached as appendix.

Most MODS require 2 to 3 hours of indoor or outdoor laboratory work but others may consist of observation and investigation of natural phenomena extended over the entire term. A few of the MODS involve large group activity (18-20 persons), some involve small group activity (5-6 persons), and most are designed for work by individuals or pairs. Except for three reading MODS and four seminars in Unified Science III, the MODS over three terms involve "hands-on science" and a dealing with the real world, whether in the laboratory or out-of-doors. When a student feels that the objectives of a MOD have been achieved, she signs up for a 10-20 minute appointment with an instructor. The instructor and the student both assess her achievements. If it is felt that more work should be done on the MOD, a later evaluation appointment is made and the process repeats itself until the desired competency is reached. If the student is judged to be successful at achieving the objectives of the MOD she then places an "X" in the appropriate block on the master checklist in the laboratory. In this manner she has tangible evidence of her achievement and is able to judge her progress relative to the rest of the class. Her term grade is based on the number of MODS (and therefore the competencies) she has completed. In Unified Science I and II this grade is set thus: 35 MODS-A, 30 MODS-B, and 25 MODS-C. If the student does not finish her work within the term she may take an "incomplete" (over six weeks) and bring her grade up to the minimum expected level of achievement. To date, out of 216 term enrollments, only six students have had to take an "incomplete" and none have failed the course.

Personnel Involved

The faculty teaching Unified Science are members of science departments with backgrounds in biology, chemistry, physics, astronomy, and earth sciences. One member of this staff is specialized in science education and, in addition to his work in Unified Science, acts as the observer of all the preservice science

teaching done in the program. Excellent cooperation and mutual respect between the biological science faculty and physical science faculty have made it possible to construct courses which are process-based and which cut across many scientific disciplines. There is also very good rapport between the Unified Science faculty and the Education Department.

The staff involved in the development, trial teaching, and revision of the program over the past three and one-half years are listed.

Mr. Oscar Horner (Cellular Biology)
Director of the Program
Department of Biology

Dr. Dennis Battaglini (Science Education, Astronomy)
Department of Biology

Sister Margaret Pirkl (Physics)
Department of Mathematical Sciences

Sister Aelred Sidel (Botany)
Department of Biology

Budget

The development of the program has been largely supported by a grant from the National Science Foundation. Over a four year period a total of $166,620.00, not including indirect costs, will be allocated. These funds have been or will be used for the following categories.

1. Faculty, Secretary, Consultant Salaries 147,530.00
2. Faculty Travel 4,800.00
3. Supplies and Renovations 9,890.00
4. Summer Conferences 4,400.00

The above are considered developmental costs. After the developmental period the courses at the College can be continued at a minimal increase over the costs of the traditional science requirements offered in the past for prospective elementary education majors. It should be noted that competency-based programs have a slightly high requirement in terms of faculty equivalents needed per

course. The science staff estimate that the continued offering of the program in the future will require an increase of 1/3 faculty equivalent per academic year.

Students will be assessed a $10.00 laboratory fee for each of Unified Science I, II, and III. An approximate number of 30 students taking the course will provide an income of approximately $1000.00. These funds will more than compensate for duplicated materials, expendable materials supplies, field trips, and films.

Evaluation of the Program

The Unified Science Program at the College of Saint Teresa has as its ultimate goal the training of a teacher who can and will teach science within the philosophies of the new generation of elementary science curricula. In the evaluation of our program we must attempt to measure a variety of qualities in order to ascertain whether we are reaching this goal.

1. We must measure certain attitudes that the students have before and after doing the work assigned in the developed science curriculum. What are their own attitudes toward science teaching, science, inquiry approach to teaching, and children?

2. We must measure the effect of the student teaching experience on the attitudes thus far generated in the science curriculum.

3. We must measure students' process skills (as listed in SAPA) before and after the participation in the program.

4. We must observe the students as they teach in the elementary classroom in order to evaluate their science teaching styles. These observations are done both within the Unified Science course sequence and later during the student teaching experience.

A semantic differential was used to detect changes of attitude toward four concepts; science teaching, science, inquiry approach, and children. The s.d. was administered before and after the three-term sequence of Unified Science. The instrument rated each of the four concepts on 12 polar scales. The intensity of

the rating was indicated by the position of a subject's check mark on a seven-step scale (the number four being neutral). The 12 polar scales were: good-bad, small-large, fast-slow, unpleasant-pleasant, strong-weak, quiet-active, clean-dirty, light-heavy, hot-cold, worthless-valuable, soft-hard, and dull-sharp.

The t-test for dependent samples was used to determine where the changes occurred on the semantics.

Results of these data indicate statistically significant favorable changes of attitude toward science in a direction consistent with our goals.

Regarding development in process skills, we have administered the SAPA Process Measure for Teachers but are not entirely happy with the test. It is planned to use the revised edition of the above test with our present class beginning the Unified Science sequence in December, 1974. We are, in general, extremely pleased with the encouraging feedback from principals and teachers in schools in which our students do student teaching. From a subjective point of view, our students do advance in process skills. We know that they do not have the "usual" fear toward the teaching of science reflected by many elementary teachers. They enjoy science teaching and apply some of the process skills they have achieved to other disciplines.